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(54) HEAT EXCHANGER
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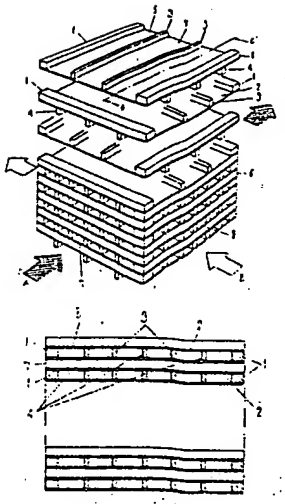
PURPOSE: To simplify a manufacturing process and to reduce manufacturing cost by integrally molding a plurality of the ribs provided on the surface of a heat transfer plate and a plurality of the ribs provided on the rear thereof so as to cross said ribs at a right angle from a resin so as to hold the heat transfer plate therebetween to form a heat exchange plate and laminating a plurality of the heat exchange plates so as to mutually shift them by 90°.

CONSTITUTION: A heat exchange plate 5 is formed by integrally molding two shielding ribs 1 and two spacer ribs 3 provided on the surface of a heat transfer plate 2 and the holding ribs 4 provided on the rear thereof from a resin so as to hold the heat transfer plate 2 therebetween. A plurality of the heat exchange plates 5 are laminated while alternately shifted by 90° so that the holding ribs 4 provided on the rears of the adjacent heat transfer plates 2 are positioned between the spacer ribs 3 provided on the surfaces of the heat transfer plates 2 to form a heat exchanger 6 having ventilation paths 7 allowing a primary air stream to flow and ventilation paths 8 allowing a secondary air stream to flow provided every one layer. Since the manufacturing process of the heat exchanger 6 consists of two processes, that is, a process for the integral molding of the heat exchange plate 5 by a molding machine and a process for laminating the heat transfer plates while mutually shifting them by 90°, manufacturing cost can be reduced.



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⑭発明の名称　熱交換器

⑳特願　平2−86595

㉒出願　平2(1990)3月30日

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明細書

1、発明の名称

熱交換器

2、特許請求の範囲

正方形の伝熱板表面の向かい合う端部に設けた、伝熱板の一辺と同寸法の2本の波へいリブと、上記波へいリブの間に所定間隔で複数本設けた間隔リブと、上記伝熱板裏面に上記間隔リブと直交し、かつ所定間隔で複数本設けた保持リブとを、上記伝熱板を間にはさんで樹脂にて一体に成型して熱交換板とし、この熱交換板を交互に90度ずらしながら、かつ熱交換板の伝熱板表面に設けた間隔リブと間隔リブの間に、隣り合う熱交換板の伝熱板裏面に設けた保持リブを位置させて複数枚積層した熱交換器。

3、発明の詳細な説明

産業上の利用分野

本発明は熱交換形換気扇等に使用する熱交換器に関するものである。

従来の技術

従来、この種の熱交換器は第3図および第4図に示すように、紙、あるいはプラスチックの薄板状の伝熱板100と、波形の間隔板101とを貼り合わせて熱交換板102とし、この熱交換板102を交互に90度ずらしながら複数枚積層して熱交換器103を形成し、1次気流Xと2次気流Yの間で熱交換をおこなう構成となっていた。

発明が解決しようとする課題

このような従来の構成では、熱交換器103の製造工程が、間隔板101の段折り→伝熱板100と間隔板102の貼合による熱交換板102の作成→熱交換器板102の切断→積層→熱交換器103の所定寸法となるよう仕上げ切断、となっており、製造コストが高くなっていた。また、積層した後での仕上げ切断では間隔板101の目がつぶれやすく、切断作業が困難であった。また、この熱交換器103を熱交換形換気扇等に使用した場合、間隔板101の板厚により、伝熱板100にて形成される通風路の有効面積が小さくなるため、抵抗損失が大きく、高静圧形の送風機が必要

となっていた。また、一般的に全熱交換用として伝熱板１００と間隔板１０１を紙にて製造するがこの場合、熱交換器１０３は非常に壊れやすく、清掃時に間隔板１０２の目をつぶしたり、落下時に破損したりする恐れがあり、また長期間の使用により、伝熱板１００や間隔板１０１が吸湿や乾燥を繰り返して収縮し、１次気流とて２次気流が混合しやすくなるなど耐久性に問題があった。

本発明は上記従来の課題を解決するもので、伝熱板表面に設けた複数のリブと、このリブと直交して伝熱板裏面に設けた複数のリブとを、伝熱板をはさんで樹脂にて一体に成型して熱交換板とし、この熱交換板を交互に９０度ずらしながら、かつ伝熱板表面のリブとリブの間に、隣り合う伝熱板裏面のリブを位置させて複数枚積層して熱交換器を形成することにより、製造工程を簡略化して製造コストを低減し、樹脂製リブによって通風路面積を大きくして抵抗損失を小さくするとともに熱交換器を強固なものとし、経年変化の少ない、耐久性のある熱交換器を提供することを目的とするものである。

課題を解決するための手段

この課題を解決するために本発明は、正方形の伝熱板表面の向かい合う端部に設けた、伝熱板の一辺と同寸法の２本の遮へいリブと、上記遮へいリブの間に所定間隔で複数本設けた間隔リブと、上記伝熱板裏面に上記間隔リブと直交し、かつ所定間隔で複数本設けた保持リブとを、上記伝熱板を間にはさんで樹脂にて一体に成型して熱交換板とし、この熱交換板を交互に９０度ずらしながら、かつ熱交換板の伝熱板表面に設けた間隔リブと間隔リブの間に、隣り合う熱交換板の伝熱板裏面に設けた保持リブを位置させて複数枚積層した構成としたものである。

作　用

この構成により、伝熱板表面に設けた間隔リブと隣り合う伝熱板裏面に設けた保持リブとが互いの伝熱板を保持し合うことになり、１次気流と２次気流の流れる通風路が一層おきに安定して形成されることとなる。

実　施　例

以下本発明の一実施例を第１図および第２図にもとづいて説明する。図において、１は正方形の伝熱板２の表面の向かい合う両端部に設けた２本の遮へいリブで、伝熱板２の一辺と同寸法となっている。３は伝熱板２の表面に設けた間隔リブで、２本の遮へいリブ１の間に所定間隔で複数本設けられている。４は伝熱板２の裏面に設けた保持リブで、間隔リブ３と直交し、かつ所定間隔で複数本設けられている。５は熱交換板で、伝熱板２を間にはさみ、伝熱板２の表面に設けた２本の遮へいリブ１と間隔リブ３と、伝熱板２の裏面に設けた保持リブ４とを樹脂にて一体に成型したものである。６は熱交換板５を交互に９０度ずらしながら、かつ伝熱板２の表面に設けた間隔リブ３と間隔リブ３の間に、隣り合う伝熱板２の裏面に設けた保持リブ４を位置させて複数枚積層した熱交換器で、１次気流を流す通風路７と２次気流を流す通風路８とを一層おきに形成する構成となっている。

上記構成において、１次気流を矢印Ａのように通風路７に流し、２次気流を矢印Ｂのように通風路８に流すと、伝熱板２により１次気流と２次気流の熱が交換される。また、熱交換器６の製造工程は、成型機による熱交換板５の一体成型→交互に９０度ずらしながらの積層、の２工程ですむので製造コストが低減でき、また、熱交換板５を成型機で成型するため寸法精度がよく、積層して熱交換器６とした後で仕上げのための切断をする必要がない。また、伝熱板２の表面に設けた間隔リブ３と間隔リブ３の間に隣り合う伝熱板２の裏面に設けた保持リブ４を位置させて積層するため、間隔リブ３と保持リブ４が伝熱板２を保持しあい、１次気流を流す通風路７と２次気流を流す通風路８とが安定して形成され、抵抗損失を小さくすることが可能となり、したがって送風機も小さくすることが可能となる。また、遮へいリブ１、間隔リブ３、保持リブ４が樹脂製のため、熱交換器６が非常に強固なものとなり、清掃時の目つぶれがなくなり、落下等でも容易に変形することも

る段

うに本発明は、正方形の
端部に設けた、伝熱板の
へいリブと、上記遮へい
数本設けた間隔リブと、
隔リブと直交し、かつ所
持リブとを、上記伝熱板
一体に成型して熱交換板
交互に90度ずらしなが
板表面に設けた間隔リブ
り合う熱交換板の伝熱板裏
位置させて複数枚積層した
。

熱板表面に設けた間隔リブ
に設けた保持リブとが互い
ことになり、1次気流と2
が一層おきに安定して形成

1次気流を矢印Aのように
次気流を矢印Bのように通風
板2により1次気流と2次気
。また、熱交換器6の製造工
熱交換板5の一体成型→交互
らの積層、の2工程ですむの
でき、また、熱交換板5を成
寸法精度がよく、積層して熱
仕上げのための切断をする必
熱板2の表面に設けた間隔リ
間に隣り合う伝熱板2の裏面
を位置させて積層するため
リブ4が伝熱板2を保持しあ
す通風路7と2次気流を流す通
て形成され、抵抗損失を小さく
なり、したがって送風機も小さ
となる。また、遮へいリブ1、
リブ4が樹脂製のため、熱交換
なものとなり、
下等でも容易に変形することも

なく、長期使用に耐えることが可能となる。

発明の効果

前記実施例の説明より明らかなように本発明は、伝熱板表面に設けた複数のリブと、このリブと直交して伝熱板裏面に設けた複数のリブとを、伝熱板をはさんで樹脂にて一体に成型して熱交換板とし、この熱交換板を交互に90度ずらしながら、かつ伝熱板表面のリブとリブの間に、隣り合う伝熱板裏面のリブを位置させて複数枚積層して熱交換器を形成することにより、製造工程を簡略化して製造コストを低減し、樹脂製リブによって通風路面積を大きくして抵抗損失を小さくするとともに熱交換器を強固なものとし、経年変化が少なく、耐久性を向上することが可能となる等の効果がある。

4、図面の簡単な説明

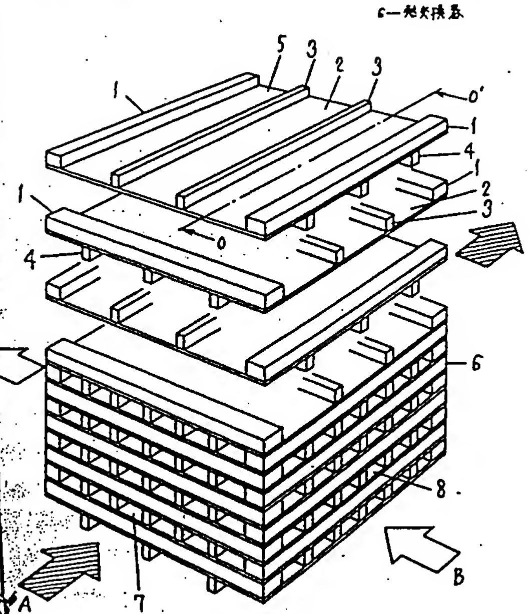
第1図は本発明の一実施例における熱交換器の斜視図、第2図は同熱交換器の第1図のO－O'断面図、第3図は従来の熱交換器の組立状態を示す斜視図、第4図は同従来の熱交換器の完成品の斜視図である。

1……遮へいリブ、2……伝熱板、3……間隔リブ、4……保持リブ、5……熱交換板、6……熱交換器。

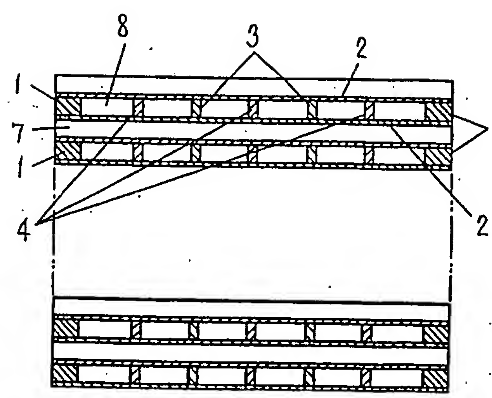
代理人の氏名　弁理士　粟野重孝　ほか1名

第1図

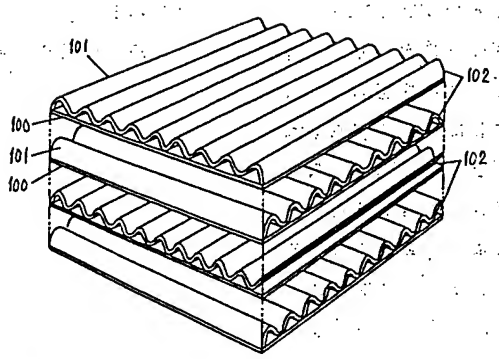
1—遮蔽リブ
2—伝熱板
3—間隔リブ
4—保持リブ
5—熱交換板
6—熱交換器



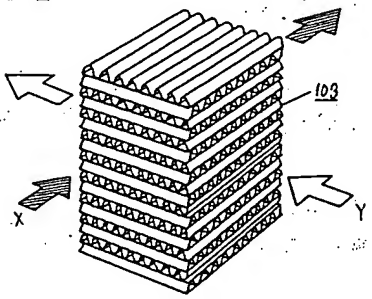
第2図

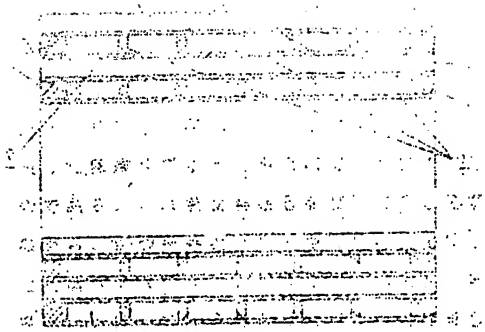


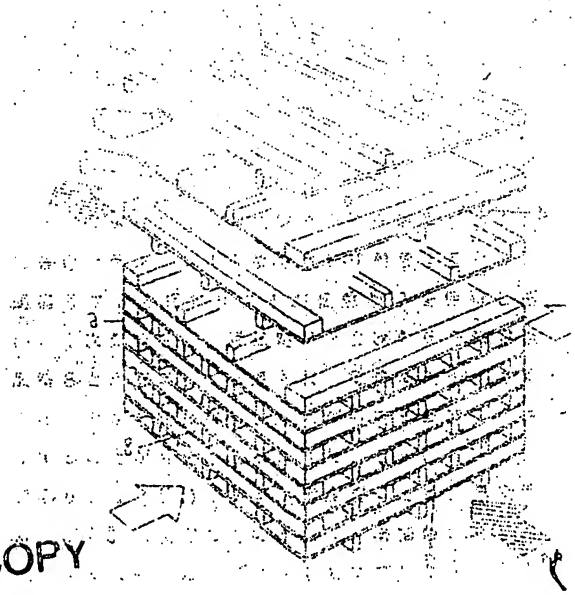
第 3 図



第 4 図







(2) Kokai (Japanese Unexamined Patent Publication) No. 3-286996
Title of the Invention: Heat Exchanger
Publication Date: December 17, 1991
Application No. 2-86595
Filing Date: March 30, 1990
Applicant: Matsushita Precision Works, Co., Ltd.
Inventor: Shinji Ogawa

CLAIM

A heat exchanger, wherein two shield ribs of the same length as one side of a square heat transmission plate are formed along the opposed end portions of the obverse surface of the heat transmission plate, wherein a plurality of spacer ribs are formed at predetermined intervals between the shield ribs, wherein a plurality of holding ribs are formed at predetermined intervals on the reverse surface of the heat transmission plate in the direction perpendicular to the spacer ribs, and wherein the shield ribs, the spacer ribs, the holding ribs and the heat transmission plate are molded into a heat exchange plate of resin, and wherein a plurality of the heat exchange plates are stacked while being displaced by 90 degrees alternately, so that the holding ribs formed on the reverse surface of the heat transmission plate of a heat exchange plate are located between the spacer ribs formed on the obverse surface of the heat transmission plate of an adjacent heat exchange plate.

3. Detailed Description of the Invention

Industrial Field of Utilization:

The present invention relates to a heat exchanger used for a ventilation fan of heat exchange type or the like.

Prior Art:

Conventionally, a heat exchanger of this type, as shown in Figs. 3 and 4, is configured of a plurality of heat exchange plates 102, each including a thin heat transmission plate 100 of paper or plastics and a corrugated spacer plate 101 attached to each other, wherein the heat exchange plates 102 are stacked while being displaced alternately by 90 degrees thereby to form a heat exchanger 103 for performing the heat exchange operation between a primary air current X and a secondary air current Y.

Problem to be Solved by the Invention:

The process of fabricating the conventional heat exchanger 103 having the configuration described above comprises the steps of corrugating the spacer plates 101, fabricating each heat exchange plate 102 by attaching the heat transmission plate 100 and the spacer plate 101 to each other, cutting the heat exchange plates 102, stacking the heat exchange plates 102, and finish cutting to complete the heat exchanger 103 of a predetermined size. This process involves a high fabrication cost. Also, the finish cutting after stacking is liable to squash the spaces of the spacer plates 101, which makes the cutting work difficult. In

the case where this heat exchanger 103 is used for a ventilation fan of heat exchange type or the like, the thickness of the spacer plates 101 reduces the effective area of the air paths formed on the heat transmission plates 100, and the resultant increased resistance loss requires a fan of a high static pressure type. Generally, the heat transmission plate 100 and the spacer plate 101 are formed of paper for total heat exchange. In this case, the heater exchanger 103 is easily broken, with the probable result that the spaces of the spacer plates 102 are squashed at the time of cleaning or ruptured by being dropped. Also, after long use, the heat transmission plates 100 and the spacer plates 101 repeatedly absorb moisture or are dried, thereby making the primary air current and the secondary air current liable to mix with each other for a reduced durability.

The present invention is intended to solve these problems of the prior art, and the object thereof is to provide a highly durable heat exchanger comprising a plurality of heat exchange plates each configured of a heat transmission plate, wherein a plurality of ribs are formed on the obverse surface of the heat transmission plate, and a plurality of ribs perpendicular to the ribs on the obverse surface of the heat transmission plate are formed on the reverse surface of the same heat transmission plate, wherein the two types of ribs with the heat transmission plate therebetween are integrally molded, using a resin material, into a heat exchange plate of resin, and wherein a plurality of the heat exchange plates are stacked while being displaced alternately by 90 degrees, so that the ribs on the reverse surface of a given heat transmission plate are located between the ribs on the obverse surface of an adjacent heat transmission plate in staggered fashion, thereby forming a heat exchanger. In this way, the fabrication process is simplified for a reduced fabrication cost, the resin ribs reduce the resistance loss by increasing the area of the air paths, and the strength of the heat exchanger is increased, while at the same time reducing variations.

Means for Solving the Problems:

In order to solve these problems, according to the invention, there is provided a heat exchanger, wherein two shield ribs of the same length as one side of a square heat transmission plate are formed along the opposed end portions of the obverse surface of the heat transmission plate, wherein a plurality of spacer ribs are formed at predetermined intervals between the shield ribs, wherein a plurality of holding ribs are formed at predetermined intervals, wherein the shield ribs, the spacer ribs, the holding ribs and the heat transmission plate are molded into a heat exchange plate of resin, and wherein a plurality of the heat exchange plates are stacked while being displaced by 90 degrees alternately, so that the holding ribs formed on the reverse surface of the heat transmission plate of a heat exchange plate are located between the spacer ribs formed on the obverse surface of the heat transmission plate of an adjacent heat exchange plate.

Operation:

As the result of this configuration, the spacer ribs arranged on the obverse surface of a heat transmission plate and the holding ribs arranged on the reverse

surface of an adjacent heat transmission plate cooperate with each other to hold the heat transmission plates. In this way, air paths for passing the primary air current and the secondary air current are formed positively and stably in alternate layers.

Embodiments:

An embodiment of the invention will be explained below with reference to Figs. 1 and 2. In the drawings, numeral 1 designates two shield ribs of the same size as one side of a square heat transmission plate 2, which shield ribs are formed along the opposed end portions, respectively, on the obverse surface of the heat transmission plate 2. Numeral 3 designates a plurality of spacer ribs arranged on the obverse surface of the heat transmission plate 2, which spacer ribs are arranged at predetermined intervals between the two shield ribs 1. Numeral 4 designates a plurality of holding ribs arranged at predetermined intervals on the reverse surface of the heat transmission plate 2 in positions perpendicular to the spacer ribs 3. Numeral 5 designates a heat exchange plate of resin formed by integrally molding the heat transmission plate 2, the two shield ribs 1 and the spacer ribs 3 arranged on the obverse surface of the heat transmission plate 2 and the holding ribs 4 arranged on the reverse surface of the heat transmission plate 2. Numeral 6 designates a heat exchanger comprising a plurality of heat exchange plates 5 stacked by being displaced 90 degrees alternately, so that the holding ribs 4 arranged on the reverse surface of a heat transmission plate 2 are located between the spacer ribs 3 arranged on the obverse surface of an adjacent heat transmission plate 2, and air paths 7 for passing the primary air current and air paths 8 for passing the secondary air current are formed in alternate layers.

In the configuration described above, the primary air current is passed through the air paths 7 as indicated by arrow A, and the secondary air current is passed through the air paths 8 as indicated by arrow B. Then, the heat of the primary air current is exchanged with the heat of the secondary air current by the heat transmission plates 2. The heat exchanger 6 can be fabricated only through the two steps of integrally molding the heat exchange plate 5 by a molding machine, and stacking the heat exchange plates 5 while displacing them alternately by 90 degrees. Thus, the fabrication cost can be reduced. Also, since a molding machine is used to mold each heat exchange plate 5, a high dimensional accuracy can be secured. After stacking the heat exchange plates 5 into a heat exchanger 6, therefore, the process of finish cutting is not required. Further, in view of the fact that the holding ribs 4 arranged on the obverse surface of a heat transmission plate 2 are located between the spacer ribs 3 arranged on the reverse surface of an adjacent heat transmission plate 2, while stacking the heat exchange plates, the spacer ribs 3 and the holding ribs 4 cooperate with each other in holding the heat transmission plates 2. Thus, the air paths 7 for passing the primary air current and the air paths 8 for passing the secondary air current are positively and stably formed alternately. In this way, both the resistance

loss and the size of the fan can be reduced. Also, since the shield ribs 1, the spacer ribs 3 and the holding ribs 4 are formed of resin, the strength of the heat exchanger 6 is greatly increased. As a result, the spaces are prevented from being squashed at the time of cleaning, and the heat exchanger 6 is not easily deformed even if dropped, thereby lengthening the service life thereof.

Effects of the Invention:

As apparent from the foregoing description of an embodiment, according to this invention, there is provided a heat exchanger comprising a plurality of heat transmission plates, each of which includes a plurality of ribs arranged on the obverse surface thereof and a plurality of ribs arranged on the reverse surface thereof in the direction perpendicular to the ribs on the obverse surface, wherein the ribs and the heat transmission plate therebetween are integrally molded using a resin material thereby to form a heat exchange plate, wherein a plurality of the heat exchange plates are stacked while being displaced alternately by 90 degrees, so that the ribs on the reverse surface of each heat transmission plate are located between the ribs on the obverse surface of an adjacent heat transmission plate, thereby forming a heat exchanger. In this way, the fabrication process is simplified for a reduced fabrication cost, and the area of the air paths is increased by the resin ribs with a reduced resistance loss while increasing the strength of the heat exchanger. In addition, the secular variations are reduced, and the durability is improved.

4. Brief Description of the Drawings

Fig. 1 is a perspective view of a heat exchanger according to an embodiment of the invention, Fig. 2 a sectional view taken in line O-O' in Fig. 1, Fig. 3 a perspective view showing the manner in which the conventional heat exchanger is assembled, and Fig. 4 a perspective view of the same heat exchanger in completed form.

1...Shield rib, 2...Heat transmission plate, 3...Space rib, 4...Holding rib, 5...Heat exchange plate, 6...Heat exchanger.

Drawing

1...Shield rib
2...Heat transmission plate
3...Space rib
4...Holding rib
5...Heat exchange plate
6...Heat exchanger